Though obliged on account of their number to omit the forms and subforms, the catalogue contains 215 species, almost 600 varieties, and about 2000 bibliographical citations. The names are all alphabetically arranged, so that reference is easy. Synonyms appear in their proper place alphabetically and are also grouped chronologically under the species to which they are referred. Such work as this is too little appreciated, but deserves the fullest recognition because it saves others hours of time and does a great deal to facilitate study.

The paper is reprinted (and repaged) from the tenth volume of the *Bulletin de la Société d'Histoire Naturelle d'Autun* (for 1897), the first page of text (p. 3) corresponding to p. 235 of that volume.—C. R. B.

NOTES FOR STUDENTS.

IT IS CURIOUS to find M. Henri Coupin, in experiments to determine the toxic dose of various substances for plants, using *percentage* solutions. If the new knowledge of solutions has taught physiologists anything, it is that percentage solutions of different substances are absolutely incomparable, and to base a comparative research on them now is absurd. The first paper of a promised series is on the toxicity of sodium chloride and sea water.[6] The seedlings of peas and wheat were supported at the surface of the solutions by pins, whose corrosion no doubt adds considerably to the toxicity of the fluids. With such sources of error, the series of experiments does not promise to be valuable.—C. R. B.

MOST INVESTIGATIONS as to the effect of the X-rays seem to be yielding negative results. Schober and Müller find no heliotropic action; Beauregard and Guichard, and Atkinson find that they do not affect the vitality of bacteria; the latter also observed no effect on oscillarias or the sensitive plant. MM. Maldiney and Thouvenin now report[7] that the X-rays have no effect in the formation of chlorophyll. These investigators, however, show that the germination of certain seeds is hastened by exposure for an hour or more to X-rays.

THE LLOYD LIBRARY is coming to be known throughout this country and Europe as one of the most important botanical libraries. Two years ago we asked Mr. C. G. Lloyd to prepare for the GAZETTE a brief account of this library. He acceded to this request, but his absorption in other work and his frequent prolonged absences from this country have interfered with the plan. Now a description of the library has been published by Dr. E. Kremers, editor of the *Pharmaceutical Review*, in that journal (**16**: 85–94.

[6] Revue général de Botanique **10**: 177. May 1898.

[7] Revue général de Botanique **10**: 81. 1898.

1898). To that description we refer our readers. A few of its salient facts we reproduce here.

The founders of the library are John Uri Lloyd and Curtis Gates Lloyd, brothers, who constitute the firm of Lloyd Brothers, extensive manufacturing pharmacists of Cincinnati. The small collection of text-books purchased by the two brothers while serving their apprenticeship in drug stores, constitutes the nucleus of the present handsome library. It has been found advisable to divide it into two departments, one embracing pure botany, in charge of C. G. Lloyd; the other, embracing medical botany, pharmacognosy, pharmacy, and related branches, in charge of J. U. Lloyd, and since 1894 in custody of his assistant, Dr. S. Waldbott. The library is being constantly enlarged by the liberal acquisition of new books and serials. It now comprises approximately 4000 volumes and 1000 pamphlets in the pharmaceutical department, and about 5500 volumes and 3000 pamphlets in the botanical division. There is also in the same building a large herbarium and about 1500 jars of fleshy fungi preserved in alcohol. A building at 224 Court street was purchased in 1891 to house these collections, and though it was then considered ample for some years to come, it had to be enlarged in area and a third story added in 1895 to accommodate the increase. Persons who desire to utilize the exceptional facilities of the library are accorded every possible privilege at Cincinnati, and books are even generously loaned to those at a distance. Professor Flückiger was struck by the remarkable resources of this library when on a visit to this country some years ago, and endeavored to persuade Mr. Lloyd to donate it to some German University. But its founders have determined to donate or bequeath it intact to some educational institution in this country where it can accomplish the most good.—C. R. B.

FOR MORE THAN forty years, notwithstanding close search and careful experimentation, no one was able to add much of importance to the descriptions given by Hofmeister and Mettenius of the gametophytes of Botrychium and Ophioglossum. Hence, when Mr. E. C. Jeffrey published a preliminary statement in the *Annals of Botany* announcing his discovery of more than six hundred prothallia of *Botrychium Virginianum*, botanists awaited the full results of his studies with considerable interest. These have now been published,[8] and, as was expected, prove to be a most valuable contribution to morphology, and by far the most complete investigation of the gametophyte of any of the Ophioglossaceæ that has yet been made. Only one gap in the life history now remains to be filled, viz., that between the chlorophyll-bearing three-celled prothallia obtained from the spores by Professor Campbell, and the tuberous saprophytic form of the mature prothallia.

The prothallia of *Botrychium Virginianum* are oval in shape, destitute of

[8] The gametophyte of *Botrychium Virginianum*. Edward C. Jeffrey. Trans. Canadian Institute —: 265–294. 1896–7.

chlorophyll, and entirely subterranean, ranging in size from 2 to 20^{mm} in length, and from 1.5 to 15^{mm} in breadth. Growth is carried on by means of an apical meristem of probably a single cell situated on the upper anterior side. All the prothallia found were infected with an intracellular endophytic fungus which occupies the lower portion of the gametophyte body, with the exception of two or three outer layers of cells. This fungus Mr. Jeffrey regards as intermediate between a Completoria and a Pythium, since it agrees with the former in its mode of penetration into the host and its possession of large vesicles, and with the latter in the formation of its conidia and the structure of the filamentous part.

The reproductive organs are confined to a median ridge on the upper surface of the prothallium. The antheridia, in mode of origin and development, agree pretty closely with those of other eusporangiate pteridophytes, but the antheridial wall becomes two-layered. The spermatozoids are of the usual filicineous type, large and multiciliate. In the developing spermatozoids no structure was observed comparable to the blepharoplast of Zamia described by Webber, or the "Nebenkern" seen by Belajeff in Filicineæ and Equisetineæ. The archegonium also originates in a superficial cell. It does not differ strikingly from other fern archegonia, but conforms more closely to those of the higher Leptosporangiatæ than to those of Marattia and Ophioglossum, having a protruding neck, small evanescent ventral canal cell, and non-septate binucleate neck canal cell.

Still more interesting is the growth of the embryo. The first or basal wall is transverse, as in all eusporangiate pteridophytes, and median and octant walls follow. But then regularity ceases, and owing to the late appearance of the embryonic organs it was impossible to assign them to definite quadrants of the segmented oospore. The half-grown embryo presents some resemblance to that of Isoetes, since the lower half forms the foot, and the upper half gives rise to stem, cotyledon, and root. Unlike Isoetes, however, but like Equisetum, it has the stem apex differentiated before the first appearance of the cotyledon. The older embryonic organs, except the foot, grow from well-defined apical cells. The gametophyte is remarkably persistent, having been found in one instance attached to a sporophyte eight years old.

Mr. Jeffrey's paper deals also with the stem anatomy of the young sporophyte.

Undoubtedly these results will strengthen the view that the eusporangiate type of pteridophyte is the more primitive. Just which genus is most like the primitive stock it might not be wise at present to conjecture, but it is interesting to note that Botrychium presents points of contact with each of the very divergent lines, Marattiaceæ, Leptosporangiatæ, Isoetaceæ, Equisetineæ, and Lycopodiaceæ.—WILSON R. SMITH.

WE CALL ATTENTION to a series of papers which may be overlooked by plant physiologists who fail to keep an eye on the general literature of physiology. These papers record some of the researches of Professor Jacques Loeb and his students in the Hull Physiological Laboratory of the University of Chicago. Several have appeared recently in Pflüger's *Archiv*.[9]

The interest of these papers to botanists lies, of course, in the unity of the facts which they present with those observable in plants, and in the theoretical discussions which must necessarily be applicable to both. Some of these we here summarize.

It is interesting to find that the development of polyps in colonies of *Eudendrium racemosum* is dependent upon light, and that only the more refrangible part of the spectrum is efficient in calling out this reaction; a relation which at once recalls the phenomena of heliotropism, both in plants and animals. Professor Loeb explains this reaction in accordance with Sachs' theory; that under the influence of light certain substances are produced which further the formation of polyps, while in darkness these substances are not produced at all or only in small quantities. On this we remark that these substances are not necessarily the plastic products themselves, but, as Beyerinck suggested, may be substances which act after the fashion of an enzyme to hasten the necessary chemical processes. Indeed, this seems *a priori* more probable.

The peculiar dissolution of the protoplasm of many protozoa on the anodal side when traversed by a constant galvanic current, and the activity of the skin glands of Amblystoma on the anodal side under the same conditions are the reverse of the reaction of the common nerve-muscle preparation, in which, on the closure of the circuit, stimulation begins at the cathode. To explain this discrepancy, Loeb and Budgett seek to establish the theory that the action of a galvanic current on irritable structures is only indirect, the current producing electrolysis. In the nerve-muscle preparation, they would say, there was electrolysis of the internal fluids of these structures. In the exceptional cases above noted, they show that the current produces electrolysis of the surrounding fluid, and that what is called the electrical

[9] LOEB, J.—Ueber den Einfluss des Lichtes auf die Organbildung bei Thieren. Archiv f. die ges. Phys. **63**: 273–292. 1896.

LOEB, J. and BUDGETT, S. P.—Ueber die Ausscheidung electropositiver Ionen an der äusseren Anodenfläche protoplasmatischer Gebilde als Ursache der Abweichungen vom Pflüger'schen Erregungsgesetz. *Ibid.* **65**: 518–534. *pl. 1.* 1897.

LOEB, J.—Zur Theorie der physiologischen Licht- und Schwerkraftwirkungen. *Ibid.* **66**: 439–466. *f. 2.* 1897.

LOEB, J.—Physiologische Untersuchungen über Ionenwirkungen. I Mittheilung. Versuche am Muskel. *Ibid.* **69**: 1–27. 1897.

LOEB, J.—Ueber die physiologische Wirkung elektrischer Wellen. *Ibid.* **69**: 99–114. *f. 9.* 1897.

action of the current is really chemical and molecular (poisoning) action of the electropositive ions set free at the anode, which leads to the formation of alkalies in that region. In support of this they point out that a certain duration of the current is necessary for the production of any reaction, and show that the effect of dilute alkalies is precisely the same as the effect of the current at the anode. The authors think it probable that all galvanic action is indirect in the same sense.

In the paper on the theory of the physiological action of light and gravity, Professor Loeb expresses confidence in the complete analogy between electric and photic stimuli; theorizes on the source of energy for geotropic phenomena; demonstrates clearly (in certain cases at least) the mechanics of stimulation curves; and discusses the so-called "light sense" of eyeless animals. The energy for geotropic curvatures he ascribes to such change of position of substances in the cell as increases or decreases the surface for chemical reactions. This change is conceived as due to the unequal specific gravity of the different substances which become spatially rearranged when the organ is displaced. Such rearrangement leads, directly or indirectly, to the increase of the chemical reaction surfaces of the materials in the cells on the under side of the stem, and their decrease in those on the upper. This theory reminds us strongly, *mutatis mutandis,* of the oldest explanation of geotropism.

As to the mechanics of curvatures, Loeb holds that in all organisms, animal or plant, whether growing, locomotive, or attached, there is the same variable, viz., contractile protoplasm, whose contraction is brought about by stimuli, and that this contraction is the efficient cause of the curvatures. This agrees well with observations on the shortening of the cells on the concave side of plant organs, and the accumulation of osmotically active substances in the cells of that side. Loeb adds a beautiful demonstration from Campanularia, a hydroid polyp.

In the first of a series of papers on the physiological action of ions, Loeb calls attention to the fact that Kahlenberg and True, who were the first to study this general subject, used as a test organism one which did not permit sufficiently accurate discriminations. Loeb has used muscle, and determined the effect of H and HO ions in equivalent solutions upon the increase of the muscle in weight when immersed in a physiological salt solution. In general it was found that the physiological action of dilute inorganic acids and bases was equal when the number of H or HO ions per unit-volume was equal. For organic acids this was not true, on account of the anions and undissociated molecules. The relative poisonousness of ions of the groups Li, Na, K, Rb, Cs, and Be, Mg, Ca, Sr, Ba depends on the rate of migration of the ions and not on the atomic weight of the elements.—C. R. B.